

Ultrasonographic assessment of normal prostate volume and splenic length among Urhobo ethnic group in Delta State of Nigeria

ABSTRACT

Introduction: Ultrasonographic imaging has been demonstrated as the fastest and safest modality in the evaluation of localized diseases in the spleen and prostate gland. **Aim:** This study was aimed at assessing the splenic length and prostate volume dimensions of the Urhobos with the use of ultrasound. **Materials and Methods:** 317 healthy Urhobo subjects aged between 18 - 60 years at the radiology department of Central Hospital Warri and Capitol Hill Hospital Oleh, Delta state were used for this study. Splenic length and prostate volume were ascertained using a Sonoace 1500 ultrasound machine according to standard radiologic technique. Data obtained were subjected to Statistical Package for Social Sciences (SPSS version 20) and were analysed using Pearson's correlation at a probability of 0.01 % (99% confidence limit). **Results:** It showed a higher splenic length in males compared to females and also recorded an increase in prostate volume with increasing age. **Conclusion:** This study has demonstrated no gender differences in splenic length dimensions and has also revealed a positive correlation between age and prostate volume in the Urhobos.

Key words: Diagnostic medicine, prostate, radiology, ultrasonography

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INTRODUCTION

Morphometric analyses of organs with the use of radiologic techniques have been shown to be imperative in the evaluation of localized or systemic diseases.^[1] The radiologic anatomist has described inaccuracy with physical examinations of organs morphometry as it provides misleading results involving a particular organ for prognostic and diagnostic purposes.^[1]

Among the various advancements in medical imaging, ultrasonography has been shown to give accurate details in normal prostate volume and splenic length evaluation.^[2] Ultrasonography has been described as a noninvasive technique that uses sound waves in medical imaging of soft tissues.^[3] In addition, ultrasound has been documented to provide easiest and assessable means of measuring splenic dimensions, prostate volume, and prostate zonal anatomy.^[3]

A study by Glenister,^[4] in 1997, reported that prostate volume at birth measures 250 mm³ and 100,000 mm³ at puberty. Glenister^[4] further elaborated the fact that prostate volume will continuously increase as the age increases all through a man's life. Splenic size has been reported to be enlarged in a variety of pathologic conditions which usually becomes 2-3 times higher than its own length.^[5] Disorders associated with changes in splenic size and height as described by Kinderknecht in 2004, varied from immunologic conditions to neoplasm and viral infections.^[6]

Evelyn *et al.* stated that most prostate abnormalities are diagnosed by measuring their dimensions.^[7] This study further highlighted the relevance of prostate volume estimation in prostate cancer, of which ultrasonography proved very essential.

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Eze *et al.* carried out a study on the prostatic size and volumes of the Benue people using transabdominal pelvic ultrasonography between the ages of 20–29 years, 30–39 years, 40–49 years, 50–59 years, 60–69 years, and 70–79 years.^[8] The study revealed the strong positive relationship between prostate volume and age, and the mean prostate volume was 8.78 cm³, 13.9 cm³, 15.09 cm³, 15.09 cm³, 18.63 cm³, 19.04 cm³, 24.91 cm³, and 34.41 cm³, respectively.^[8]

Another study was carried out by Ogbeide and Ebubedike, on 200 Nigeria adults at the Radiology Department of University of Benin Teaching Hospital.^[9] This was to determine the normal volume of the prostate gland and a mean prostate volume of 19.620 cm³ was reported.

A study on a normal spleen length on 200 Nigerian adults was carried out by Ehimwenma and Tagbo in 2011.^[10] The study revealed a mean splenic length of 11.1 cm in males and 10.1 cm in females. The findings also stated no significant difference between splenic length and gender.

A cohort study carried out by Ezeofor *et al.*, (2013), on sonographic assessment of normal spleen limits in healthy schoolchildren in South East Nigeria showed a significant correlation between splenic length and age.^[11] The study further revealed that males had statistical longer splenic length than females.

A study has demonstrated that splenic length and prostate volume differ among races, gender, age, body weight, and height.^[12] Several studies have been conducted on the measurement of splenic and prostate dimensions among Caucasians, Mongoloid, and some parts of Africa including Nigeria.^[3,7,12]

Prostate cancer metastasis has been demonstrated to occur in the lymph nodes and could spread to anywhere in the body.^[13] The spleen has been reported as one of the rare locations of prostate cancer.^[13] However, due to the dearth of literatures on relationship of normal splenic length and prostate volume estimation among the Urhobos in Delta State, this research was, therefore, aimed at determining the ultrasonographic assessment of splenic length and prostate volume dimension among the Urhobo ethnic group in Delta State of Nigeria. This will provide baseline data in the assessment of splenic and prostate abnormalities.

MATERIALS AND METHODS

Approval for this study was sought from the Department of Human Anatomy and Cell Biology, Faculty of Basic Medical Science, Delta State University, Abraka, Ethics Committee with reference number Delsu/chs/ana/205. This was a prospective study carried out in the Radiology Department of Central Hospital Oleh and Capitol Hill Hospital both in Delta State, Nigeria. These hospitals are

secondary health-care hospitals with a hospital bed capacity of about 350-bed space with different units/departments. A total number of 317 healthy adults (220 males and 97 females) which belonged to the Urhobo ethnic group in Delta State were considered fit for this study. Sample size was lesser in females compared to males because women do not have prostate glands. Healthy adults, who were not from this ethnic groups or patients with any form of lymphoid disease, spleen and prostate abnormality, were excluded from this study.

Participant's biodata such as age which ranges from 18 to 57 years, sex, and weight were obtained before ultrasound examination. The participants were instructed to fill their urinary bladder so as to increase the echogenicity of the prostate. A transabdominal scanning method was used to visualize the prostate. The prostatic dimensions such as cephalocaudal length L, anteroposterior height H, and transverse width W were evaluated while the prostate volume was computed using the ellipsoid formula as described by Bakker *et al.* and Walz *et al.*^[14,15] Obtained image was processed using MATLAB software and was passed through a median filter, which was used to smoothen, sharpen the image and to reduce the noise effect. Prostate volume was evaluated using the ellipsoidal formula:

$$\text{Prostate volume} = 0.524 \times L \times H \times W$$

Splenic length was measured as the optical maximum distance obtained at the hilum of the spleen on the longitudinal coronal view between the most superomedial and most inferolateral points.^[14]

Data obtained were subjected to Statistical Package for Social Sciences (SPSS) software version 20, IBM and was analyzed using Pearson's correlation contingency statistics with levels of statistical significance determined at 0.01 level.

RESULTS

Table 1 shows a descriptive statistics of gender differences in the mean splenic length of participants. The minimum splenic length of females was higher than that of the males with a lower maximum length of 13.30 compared to that of males which was 13.70. Males were seen to have the highest mean splenic length. The Pearson's correlation coefficient between the mean splenic length of males and females was $r = 0.095$. This shows a nonstatistically significant relationship between splenic length and gender.

Table 2 shows the mean prostate volume of different age ranges. Among the five age ranges, males between the ages of 50 and 57 had the highest prostatic volume of 28.89, whereas the lowest prostatic volume of 19.97 was seen the least age. The table also demonstrated a simultaneous increase in body weight accompanied by a continual

increase in prostate volume. This resultant pattern thus indicated that prostatic volume increases with age and body weight. The Pearson’s correlation coefficient between the mean prostate volume and age of males was $r = 0.625$. This shows a statistically significant relationship. Hence, mean prostate volume strongly correlated with age.

DISCUSSION

Assessment of prostatic volume and splenic length is best demonstrated with the use of ultrasound.^[3] Ultrasonographic imaging is very essential in the detection of prostatic abnormalities and splenomegaly and could also provide a database in the diagnosis of endemic diseases associated with changes in the spleen and prostate gland.^[16]

Normal values of the spleen dimensions are essential parameters in clinical radiologic practice. This index study demonstrated no significant difference between the splenic length of males and that of females of Urhobo participants ($r = 0.624$) but recorded higher splenic length values in males compared to females. This finding agrees with a study by Soyupak *et al.* in 2002 and Ezeofor *et al.* in 2013 who also reported no significant difference between splenic length and gender with splenic length in males to be longer than that of females.^[1,11,17]

This resultant pattern, however, indicated that there is no gender difference in spleen dimension as such; gender is not a determining factor in the spleen length of the Urhobos. Findings from these study also concur to that of a study on normal spleen dimension by Ehimwenma and Tagbo, who also reported higher mean splenic length in males (11.1 cm) compared to that of females (10.1 cm).^[10] A similar observation was noted in a study of normal splenic length dimensions in a study carried out by Loftus and Metreweli (1997); in a Chinese population where splenic length in males was higher than the females.^[18] These observations,

therefore, implied that no racial differences exist between splenic length among tribes and races.

Accuracy in prostate volume estimation is very imperative in the estimation of prostate-specific antigen index and divergence which are essential in distinguishing the extent of a prostatic tumor disease.^[19] Abnormal prostate enlargement has been reported to be due to inflammation or virus infection and in severe cases, may indicate prostate cancer.

This study has clearly demonstrated the mean prostate value of varying age ranges using transsuprapubic ultrasonographic scan technique. Findings from the present study indicated a statistically significant transient increase ($r = 0.625$) in the volume of prostate as age increased. This, therefore, implied that age showed a strong positive correlation with prostate volume and hence could be said to be a determining factor in prostate dimensions. These findings agree with previous studies which reported an increase in prostate volume with increasing age and also a positive relationship between age and prostate volume.^[20,21] However, these findings could be attributed to the assertion that prostate size is affected by aging which was clearly demonstrated in the index study.

This study further revealed the mean prostate volume of the Urhobos for all the ages (24.64 cm³) to be higher when compared to that of the Caucasians (19.90 cm³),^[21] the Benue people (19.22 cm³),^[8] and that of asymptomatic adult Nigerians whose mean prostate volume was reported to be 19.62 cm³.^[9] Reasons for this dissimilarity could be ascribed to the high mining activities in the Urhobo land which has been reported to invariably lead to prostatic hyperplasia.^[15,16]

However, the Urhobos also exhibited a lesser value of mean prostate volume when compared to that of the Ethiopians (42cc, 35cc)^[22] and the Malaysians (983738.3 mm³).^[20] Reasons for these observed differences could be attributed to the larger sample size and also the racial differences that exist between tribes.

CONCLUSION

This study has provided baseline data in splenic length and prostate volume dimension among the Urhobos and

Table 1: Comparison of gender differences in the mean splenic length of participants

Gender	N	Minimum	Maximum	Mean	SD
Male	220	8.10	13.70	11.31	1.02
Female	97	8.20	13.30	10.63	1.11

SD=Standard deviation

Table 2: Descriptive statistics of mean of participant’s weight, age range, and prostatic dimensions

Age range (years)	Weight (kg)	Cephalocaudal length	Anteroposterior height (cm)	Transverse width (cm)	Prostate volume (cm ³)
18-25	62.59	2.95	3.45	3.86	19.97
26-33	68.77	3.69	3.70	4.04	24.83
34-41	67.60	3.14	3.74	4.04	24.63
42-49	71.73	4.46	3.76	4.11	24.90
50-57	74.78	3.28	3.98	4.21	28.89

has clearly demonstrated no gender differences in splenic length dimensions and also revealed a positive correlation between age and prostate volume in the Urhobos.

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Conflict of interest

There are no conflicts of interest.

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